

Biliary Tract Cancers Among Textile and Other Workers in Shanghai, China

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Using occupational data for more than 500 patients with cancers of the biliary tract (CBT) diagnosed between 1980 and 1984 in Shanghai, and employment information from the 1982 census for the Shanghai population, the associations between CBT and occupational categories were examined by standardized incidence ratios (SIR). Compared to the general population, risk was elevated by nearly 40% among textile workers (SIR for women = 137, 95% CI = 106-175 and SIR for men = 137, 95% CI = 76-217), consistent with other investigations linking CBT to textile work. Increased risks were observed also among waiters/waitresses, male sanitation personnel and chemical workers, and female janitor and similar workers. Although causal inferences cannot be firmly drawn, our findings add to the limited evidence linking CBT to occupational exposures, especially in the textile industry.

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KEY WORDS: *biliary tract cancers, textile work, occupational risks, registry-linkage study, China*

INTRODUCTION

Cancers of the biliary tract (CBT) are relatively uncommon, accounting for less than 1% of all incident cancers in the United States [Ries et al., 1994]. In Shanghai, China, incidence rates of CBT more than doubled between 1972-1974 and 1987-1989 [Jin et al., 1993]. In 1987-1989, the rates were 2.6 and 3.5 per 100,000 men and women, respectively. The rising incidence trend suggests that environ-

mental exposures have contributed to the etiology of these tumors.

Except for gallstones, the risk factors for CBT are poorly understood [Lowenfels et al., 1985; Maringhini et al., 1987]. In the limited number of investigations on CBT and occupation, excess risks have been suggested among workers with employment in rubber plants, vinyl chloride manufacturing and chemical works, pesticide manufacturing, livestock feed processing, and painters and munitions workers exposed to dinitrotoluene [Mancuso and Brennan, 1970; Krain, 1972; Malke et al., 1986; Olsen et al., 1988; Guberan et al., 1989; Bond et al., 1990; Wong et al., 1991; Brown, 1992; Stayner et al., 1993; Amoateng-Adjepong et al., 1995]. Textile work has been linked to CBT in several studies [Krain, 1972; Malke et al., 1986; Lanes et al., 1990; Goldberg and Thériault, 1994], including two recent studies involved synthetic textile workers in cellulose triacetate fiber manufacturing [Lanes et al., 1990; Goldberg and Thériault, 1994]. Since textile manufacturing is a major industry in China, we examined CBT risk among textile workers and explored the influence of other occupational categories. In this linked registry study, the employment information

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Accepted for publication June 20, 1995.

TABLE I. Standardized Incidence Ratios for Biliary Tract Cancers by Major Occupational Categories and Sex, Shanghai, China, 1980–1984

Code	Occupation	Men			Women		
		#Obs	SIR	95% CI	#Obs	SIR	95% CI
0,1	Professionals	42	105	76–142	25	87	56–128
2	Government officials	17	87	51–139	4	56	15–143
3	Clerical workers	11	78	39–140	6	84	31–183
4	Commercial (sales) workers	26	102	66–149	20	110	67–170
5	Service workers	41	92	66–125	70	152	119–192
7,8,9	Production and transport workers	138	104	87–123	167	105	90–122

CI, confidence interval; SIR, standardized incidence ratio; #Obs, number observed.

for incident cases of CBT collected by the Shanghai Cancer Registry was compared to the population employment data for Shanghai collected as part of the Third National Census in China [Gao et al., 1990].

METHODS

Methods for this occupational cancer survey have been described in detail elsewhere [Gao et al., 1990; Chow et al., 1993]. Briefly, occupation at time of diagnosis (time of retirement for retired cases) was obtained by direct or next-of-kin interviews for Shanghai residents aged 30 or over who were diagnosed as having CBT (ICD-9 code 156) between 1980 and 1984. The diagnosis for 50% of the cases was based on pathology, 22% on computed tomography (CT) scan or ultrasound, and 4% on clinical data available at the time of reporting. For about 25% of cases, information on method of diagnosis was missing. Based on past experience with the tumor registry data, however, it is believed that most cases had further diagnostic procedures that were not reported to the registry.

Occupational categories and coding were identical to those used in the 1982 census when employment data were obtained from Shanghai residents [National Bureau of Statistics (China), 1982]. Agricultural workers were excluded from this study because few subjects were employed in agricultural work in this industrial city. At the time of the census, 1.57 million men and 1.55 million women aged 30 or over resided in the 10 districts of urban Shanghai included in the current study (henceforth referred to as Shanghai) [Office of the Shanghai Population Census, 1985].

Age- and sex-specific incidence rates of CBT for 1980–1984 were computed for Shanghai. These incidence rates were then applied to the census-derived age- and sex-specific estimates of person-years in each occupational category for the same time period to obtain the expected number of CBT cases in each group. The observed number of cases in each occupation was divided by the expected num-

ber and multiplied by 100 to obtain the standardized incidence ratio (SIR). Statistical significance was tested assuming that the observed numbers of cases followed a Poisson distribution [Bailar and Ederer, 1964].

RESULTS

More than 500 cases of CBT (275 men and 292 women) were identified during the study period. Among the six major occupational (1-digit) groups in Shanghai, only female service workers had a significant excess risk of CBT (SIR = 152, 95% CI = 119–192) (Table I). No other major occupation was associated with CBT in either men or women.

Variations in CBT risk were examined within occupational subcategories (2-digit) in the service, production and transportation work (Table II). In the service sector, female public service workers had a significantly elevated risk (SIR = 160, 95% CI = 121–207), but this was not true of male workers. Risk increased slightly among cooks of both sexes, but the associations did not reach statistical significance. In the production sector, risk was elevated by nearly 40% among textile workers (SIR for women = 137, 95% CI = 106–175 and SIR for men = 137, 95% CI = 76–217). No other production work was associated with a significant risk, but nonsignificant excesses were seen among men and women employed in metal refining and processing, and in plumbing, welding, and sheet metal works. In addition, female transportation equipment operators showed a significantly elevated risk (SIR = 267, 95% CI = 115–526), but no excess risk was seen in male counterparts. No associations were found for other transportation and production workers.

Specific (3-digit) jobs that were associated with a significant excess risk of CBT are presented in Table III. While no overall excess risk was seen among male public service workers, there were elevated risks among waiters (SIR = 274, 95% CI = 108–554) and sanitation personnel (SIR = 303, 95% CI = 115–833). Among women in public service,

TABLE II. Standardized Incidence Ratios for Biliary Tract Cancers in Service, Production, and Transportation Workers by Occupational Subcategories and Sex, Shanghai, China, 1980–1984

Code	Occupation ^a	Men			Women		
		Obs	SIR	95% CI	Obs	SIR	95% CI
5.1–5.2	Public service workers	31	92	63–131	57	160	121–207
5.3	Cooks	10	113	54–208	11	117	58–209
7.2	Metal refining and processing workers	8	113	49–223	5	134	43–313
7.3	Chemical processors and related workers	5	200	64–467	1	44	1–245
7.4	Rubber and plastic product workers	2	95	11–342	7	112	45–231
7.5	Textile workers	16	137	78–222	65	137	106–175
7.7	Tailors	5	96	31–224	21	140	87–214
7.8	Food and beverage processors	5	154	50–359	2	73	9–264
8.0	Wood workers, cabinet makers	8	108	46–213	0	—	—
8.4	Blacksmiths, toolmakers, and machine-tool operators	13	108	58–185	10	95	45–175
8.6	Electrical and electronics workers	1	18	0.5–100	9	91	42–173
8.8	Plumbers, welders, sheet metal workers	7	153	61–315	5	140	45–327
9.1	Other production and related workers	3	109	22–319	6	75	27–163
9.2	Construction workers	6	119	43–259	1	57	1–318
9.4	Material handlers, dockers, and freight handlers	14	101	55–169	2	50	6–181
9.5	Transportation equipment operators	8	64	28–126	8	267	115–525
9.6	Inspectors and product analysts	5	127	41–296	3	46	9–134
9.9	Other transportation and production workers	14	104	57–175	8	75	32–148

^aIncluded occupations with 5 or more cases in men or women.

CI, confidence interval; SIR, standardized incidence ratio; Obs, number observed.

a significant excess risk (SIR = 244, 95% CI = 173–333) was linked only to miscellaneous work (e.g., janitors, messengers, doorkeepers), while a nonsignificantly elevated risk was found in waitresses (SIR = 178, 95% CI = 77–350). Among textile workers, greater than 70% excess risk was observed for those employed in a number of specific jobs, including men who were fiber preparers (SIR = 215, 1 case), spinners and winders (SIR = 278, 4 cases), and textile machinery mechanics (SIR = 213, 7 cases), and women who were spinners and winders (SIR = 170, 29 cases), textile machinery mechanics (SIR = 431, 3 cases), and knitters (SIR = 180, 11 cases). The excess risk, however, was significant only for female spinners and winders (SIR = 170, 95% CI = 114–245). In addition, significantly elevated risks were seen among male chemical manufacturing workers and female handcart drivers. These observations, however, were based on small numbers of cases.

DISCUSSION

Our findings are consistent with previous observations relating CBT risk to textile work [Krain, 1972; Malzer et al., 1986; Lanes et al., 1990; Goldberg and Thériault, 1994]. In two recent studies, excess mortality from CBT was reported among textile workers involved in the production of

cellulose triacetate fiber [Lanes et al., 1990; Goldberg and Thériault, 1994]. While one study suggested methylene chloride as the risk factor [Lanes et al., 1990], the other found no association with this chemical [Goldberg and Thériault, 1994]. Although exposure to asbestos may occur in the textile industry [Roggli et al., 1992], there is no clear evidence linking asbestos to CBT. However, a case report revealed asbestos fragments associated with a bile duct cancer in an asbestos factory worker [Szendrői et al., 1983].

It should be noted that in Shanghai, textile work includes a small subgroup of workers (<10%) who are employed in textile machinery manufacturing. In addition, the proportion of workers employed in synthetic fiber manufacturing has also grown steadily since the debut of this industry in Shanghai during the early 1970s. During the period of this study, approximately 30% of the textile workers were employed in manufacturing of synthetic fibers. Given the broad categories of textile works in Shanghai, it is possible that workers in our study were exposed to a greater variety of chemical and physical agents than workers in other countries. In our study, excess risks were observed in most subcategories of textile work. Further studies with detailed assessment of textile exposures are needed to evaluate the specific agents that may be involved in the development of CBT.

TABLE III. Significantly Elevated Standardized Incidence Ratios for Biliary Tract Cancers by Specific Service, Production, and Transport Occupations and by Sex, Shanghai, China, 1980–1984

Code	Occupation	Men			Women		
		Obs	SIR	95% CI	Obs	SIR	95% CI
5.11	Waiters	7	274	110–566	8	178	77–353
5.22	Sanitation personnel, street cleaner	5	363	117–846	1	50	1–278
5.23	Miscellaneous workers (e.g., doormen, messengers, janitors)	15	67	37–111	39	244	174–334
7.31	Chemical manufacturing workers	4	1,122	299–2,845	0	—	—
7.52	Spinners and winders	4	278	77–711	29	170	114–244
9.57	Rickshaw and handcart drivers	4	125	34–320	7	407	163–839

CI, confidence interval; SIR, standardized incidence ratio; Obs, number observed.

Other leads to occupational factors in CBT were suggested in our study. The excess risks among waiters/waitresses and cooks may be related to lifestyle risk factors for CBT, such as cigarette smoking and dietary intake of fat and calories [Zatonski et al., 1992; Chow et al., 1994] that may be more prevalent in restaurant workers. The reason for the excess risks associated with sanitation work in men and janitorial work in women is unclear, but exposures may occur to solvents and other cleaning or disinfecting agents. In previous surveys of CBT, excess risks have been reported among painters, pesticide manufacturers, and munitions workers exposed to solvents and other agents [Malker et al., 1986; Guberan et al., 1989; Brown, 1992; Stayner et al., 1993; Amoateng-Adjepong et al., 1995]. The significantly elevated risk we observed among male chemical workers is consistent with earlier reports of a high risk of CBT in the chemical industry [Krain, 1972; Bond et al., 1990]. In addition, we found a nonsignificantly elevated risk in a category including plumbers, welders, and sheet metal workers, although the number of cases was small. An earlier report indicated an excess risk of CBT among sheet and plate metal fabrication and insulation workers in the construction industry, suggesting the possible role of asbestos [Malker et al., 1986].

Several potential limitations of our study should be considered. Because of the large number of occupations being examined and the small number of cases in selected categories, some associations could have occurred by chance. Occupation was ascertained at time of diagnosis or census only. No information was available on direct exposure assessment, lifetime occupation, or duration of employment. However, since job mobility in China during the early 1980s was still quite limited, particularly for older individuals, this single occupation ascertainment was likely to be representative of usual occupation. Another limitation is the lack of information on anatomic subsite of CBT. To the extent that certain occupational associations may be confined to specific tumors of the biliary tract (gallbladder, bile

duct, or ampulla of Vater), our ability to detect occupational risks may be limited.

A further limitation is the absence of data on the occurrence of gallstones [Maringhini et al., 1987] and other potential risk factors for CBT such as obesity and cigarette smoking [Zatonski et al., 1992; Chow et al., 1994]. While the prevalence and type of gallstones may differ greatly among populations [Nakayama et al., 1991], there are no data to suggest variations by occupational groups. Given the generally consistent patterns of risk associated with textile work between men and women in the current study, it seems unlikely that these associations are due to confounding by smoking or obesity whose prevalences vary by gender in Shanghai [Gao et al., 1994a,b]. Furthermore, the consistency of our findings with the limited data available in the literature suggests that the occupational associations are valid.

In summary, this population-based, record-linkage study of occupational risks for CBT is consistent with previous studies suggesting that textile workers are prone to this tumor. Excess risks were observed also among waiters, sanitation personnel, and a category including plumbers, welders, and sheet metal workers. Despite limitations of our study, the findings support the notion that occupational factors contribute to the development of CBT. Further studies are needed to clarify the risks of CBT among textile and other groups of workers and to identify the specific exposures and mechanisms involved.

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